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Ehrenfest's Theorem and the Quantum Hall Effect. M. H. MAC GREGOR, Lawrence Livermore National Laboratory, Livermore, CA. Ehrenfest's theorem as applied to orbiting electrons in a magnetic field B states that the quantum mechanical solution goes over quantitatively into the corresponding classical limit, provided that (a) the field B is constant over the orbit, and (b) the electron wave packet is small as compared to the size of the orbit. In the case of the two-dimensional electron motion in the quantum Hall effect, condition (a) is satisfied, but (b) is not. However, the correspondence between the Hall quantum mechanical Landau electron orbitals and the quantized classical orbits is close enough that the latter can be used to delimit the solutions of the former. The solutions thus allowed by Ehrenfest's theorem are precisely those that match the observed denominators $n = 1, 3, 5, \dots$ in the quantum Hall effect, where the Hall "filling fraction" is m/n , with $m =$ all integers. This suggests that integer ($n = 1$) and fractional ($n = 3, 5, \dots$) quantized Hall plateaus must have similar explanations, as is also indicated by the similar experimental regularities in these two types of measurements.



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